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Institut für Technische Informatik
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Computer Engineering and
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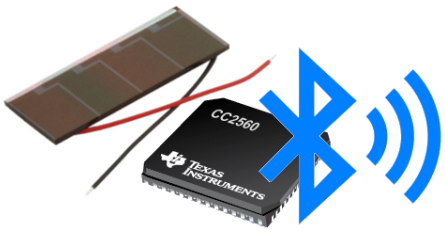
Semester Thesis:

Batteryless Bluetooth Communication

Motivation Traditional sensor nodes are usually powered from energy storage devices such as batteries or supercapacitors in order to guarantee continuous operation during periods of energy unavailability. More recently, there is a new research field which focuses on batteryless, energy-driven sensor nodes. One of the challenges is to account for the variability present in typical energy harvesting such as solar cell in indoor scenarios. Our experience shows that even in these adverse scenarios with extremely low power budgets rich data sensing and computationally intensive local processing is viable. We now want to explore the feasibility of wireless data communication with commodity devices using the Bluetooth Low Energy (BLE) protocol.

Task Description During this project you will develop an energy harvesting driven BLE sensor node that sporadically measures ambient conditions and transmits these sensors readings to surrounding smartphones.



In a first step you will familiarize yourself with the Bluetooth Low Energy (BLE) beacon transmission and the recently proposed Energy Management Unit (EMU) [1] which both will build the base for the later sensor node implementation. The individual parts will then be combined to prototype the hardware as well as the software for a battery-free, energy harvesting driven sensor node. A basic Android application that displays the received BLE packets will then be used to evaluate the rate of successfully transmitted sensor readings.

This involves the following tasks:

- Familiarization with microcontroller programming and BLE beacon transmissions.
- Integration of an ambient sensor reading and BLE transmission and optimization for energy harvesting operation.
- Implementation of a simple BLE beacon receiver to record received sensor values.
- Evaluation of the sensor nodes energy efficiency and communication performance.

Requirements: Familiarity with C/C++ programming. Experience with microcontroller programming is an advantage.

Interested? Please have a look at http://www.tec.ethz.ch/research.html and contact us for more details!

Contacts

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References

[1] A. Gomez, L. Sigrist, M. Magno, L. Benini, and L. Thiele, "Dynamic Energy Burst Scaling for Transiently Powered Systems," in Proceedings of the DATE Conference, 2016.